

TESTIMONY OF ROBERT LEHMERT
TO THE VERMONT HOUSE COMMITTEE ON
ENERGY AND TECHNOLOGY

INTRODUCTION TO BIOCHAR

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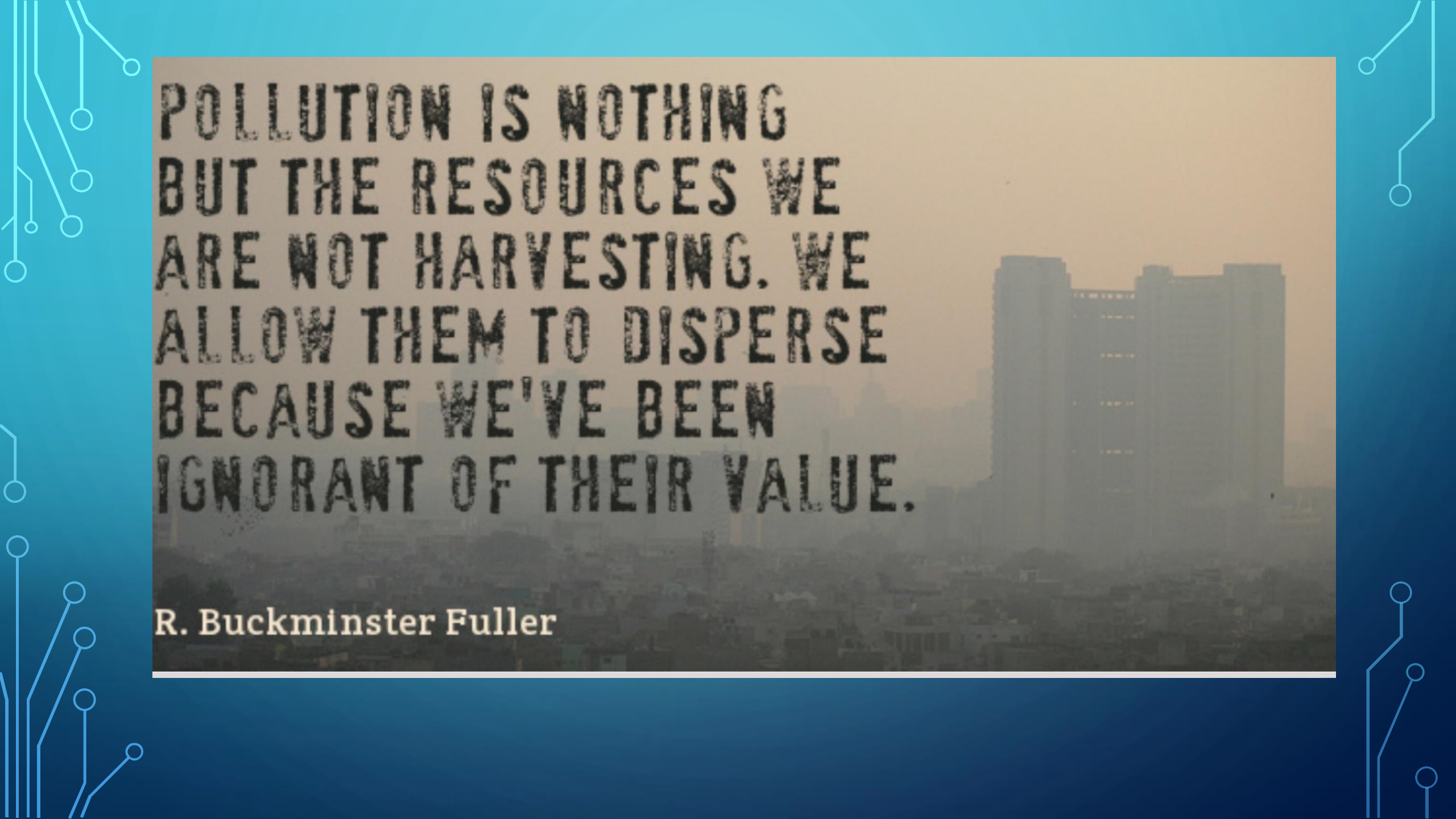
A HIGHLY CONDENSED INTRODUCTION TO BIOCHAR

PARTIALLY EXCERPTED FROM ROCHESTER INSTITUTE OF TECHNOLOGY / GOLISANO INSTITUTE FOR SUSTAINABILITY ARTICLE TITLED: “WHAT IS BIOCHAR AND HOW IS IT MADE?”

THE FULL ARTICLE MAY BE VIEWED AT [TINYURL.COM/2P9YRZ4Z](https://tinyurl.com/2P9YRZ4Z)

RIT | Rochester Institute
of Technology

Golisano Institute for
Sustainability

The image features a quote by R. Buckminster Fuller. The text is presented in a bold, black, monospace-style font, arranged in seven lines. It is set against a background of a hazy, sepia-toned cityscape with several tall buildings. The entire scene is framed by a dark blue border with white circuit-like patterns consisting of lines and circles at the corners.

POLLUTION IS NOTHING
BUT THE RESOURCES WE
ARE NOT HARVESTING. WE
ALLOW THEM TO DISPERSE
BECAUSE WE'VE BEEN
IGNORANT OF THEIR VALUE.

R. Buckminster Fuller

WHAT IS BIOCHAR?

- Biochar is produced by a conversion of organic biomass resulting in an interruption of the natural tendency of biomass to be “biodegradable” -- that is, to decompose and return its elements including carbon to the atmosphere through the process of “flux”. Although biochar will degrade (especially if in soils), the material is considered to be a permanent carbon sequester by the IPCC.
- Biochar can be a naturally-occurring carbon sequester, and is found in soils which experienced wildfires thousands of years ago
- Examples of anthropogenic biochar date back to the Amazon “terra preta soils” dating back approximately 2,000 years BCE.



“BIOCHAR BREAD” – FOUND WITHIN
AN OVEN AT POMPEI SUBSEQUENT TO
THE VESUVIUS ERUPTION 79 AD



WHAT LOCAL VERMONT FEEDSTOCKS COULD PRODUCE BIOCHAR?

FOOD WASTE & BIODEGRADABLE PACKAGING

NON-SALEABLE FOREST PRODUCTS

MUNICIPAL WOOD WASTE

MANURES OF ALL TYPES

CROP RESIDUES

WASTE WATER TREATMENT RESIDUALS

DIGESTATE

AND MORE

BASICS OF PYROLYSIS



Biochar is made by applying controlled heat to biomass -- under conditions which exclude oxygen, a process called pyrolysis. This begins with heat applied to dry the biomass so that flammable vapors are released – and directed away from the biomass without ignition – enforced by the lack of oxygen.



When oxygen is introduced, the gases ignite, and heat produced is applied to the biomass, continuing pyrolysis without direct flame (which would quickly reduce the biomass to ash).

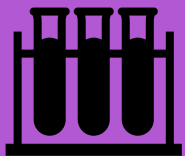
AFTER PYROLYSIS



Biomass is reduced to a mineral-like high carbon material which is electrically-charged (a mild negative charge) which has been observed to attract soil microorganisms to take up residence within its pores. It's been dubbed "the electric sponge".



The resulting biochar is characterized by nanoscale pores and tunnels, with an extraordinary interior surface area ready to be inoculated with manure, microbes, or engineered materials depending on the intended purpose.



Research reported that a specific biochar produced a total surface area and pore volume measured at 490.8 square meters per gram. (490.8 m^2/g according to Chen et al., 2008). **A football field is 5350 sq m – therefore according to Chen's methods, that's the equivalent of the total surface area within 10.9 grams of the biochar Chen studied.**

IN SOILS: A “CORAL REEF” TO FOSTER SOIL MICROBES AND MYCELIA

Creates a material characterized by impermeable surfaces and many internal cavities measured in micrometers.

Extremely large surface area for its volume.

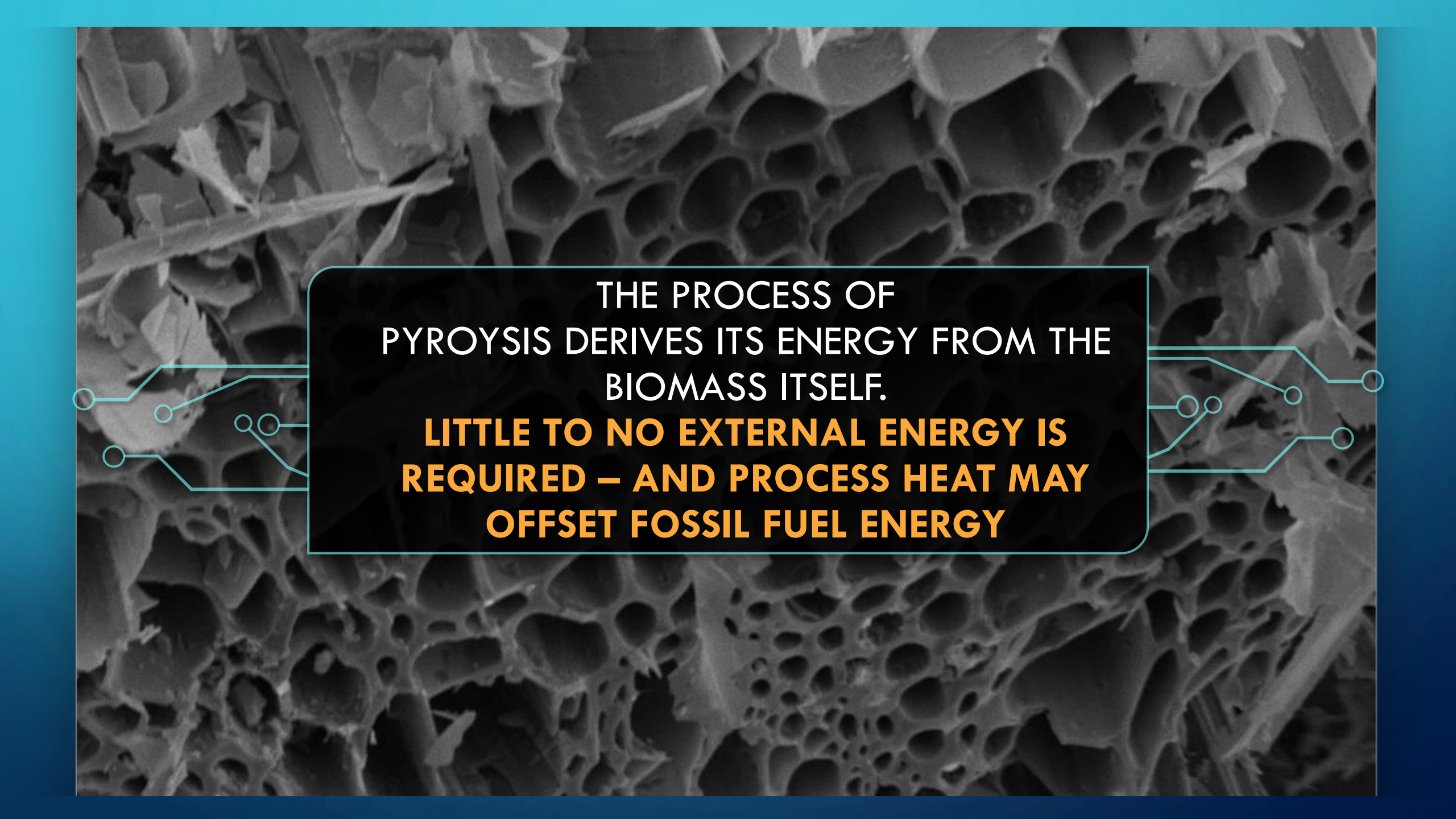
Does not ABSorb materials into its walls —it ADSorbs them onto its interior walls and cavities.

A sterile material until inoculated - do not apply to soils without first inoculating with compost, compost tea, urine, etc.

Regulates soil moisture — stores water during wet periods, releases it when dry.

Increases nitrogen retention and releases it slowly.

Aerates soils and reduces soil bulk density.

The background of the slide is a grayscale scanning electron microscope (SEM) image of biomass, showing a complex, porous, and fibrous structure. Overlaid on this image are several light blue circuit-like lines with circular nodes, extending from the left and right edges towards the central text box. The text box is a dark gray rounded rectangle with a thin light blue border.

THE PROCESS OF
PYROLYSIS DERIVES ITS ENERGY FROM THE
BIOMASS ITSELF.

**LITTLE TO NO EXTERNAL ENERGY IS
REQUIRED – AND PROCESS HEAT MAY
OFFSET FOSSIL FUEL ENERGY**



HOW CAN WE HELP VERMONT ?



IMMEDIATE AND SHORT-LEAD PRODUCT DEVELOPMENT OPPORTUNITIES

Biochar for Manure immobilization and re-purposing

- Methane suppression
- Manure lagoon covers
- Slow release fertilizers
- Animal bedding and feed supplements

Activated carbon for water and air filtration

Partnerships with Compost producers and dealers

High-performance, ultra low-carbon cement and asphalt

A recent expansion at Vermont's only landfill could be its last. What happens next?

By Emma Cotton
Jan 16 2022



Warming of 2 C would release billions of tons of soil carbon

by [University of Exeter](#)



Credit: CC0 Public Domain

Global warming of 2°C would lead to about 230 billion tons of carbon being released from the world's soil, new research suggests.


Global soils contain two to three times more carbon than the atmosphere, and higher temperatures speed up decomposition—reducing the amount of time carbon spends in the soil (known as "soil carbon turnover").

The new international research study, led by the University of Exeter, reveals the sensitivity of soil carbon turnover to global warming and subsequently halves uncertainty about this in future climate change projections.

The background is a dark teal gradient. In the corners, there are decorative white circuit-like lines with small circles at the ends, resembling a network or data flow diagram.

THERE ARE ACTUALLY TWO DISTINCT
OFFERINGS:

THE PHYSICAL BIOCHAR
AND
A SERVICE – PERMANENT SEQUESTRATION OF
CARBON
(THESE ARE SOLD SEPARATELY)



TO QUALIFY AS
LONG TERM
CARBON
SEQUESTRATION

Additionality - The carbon would not have been sequestered unless additional processes occurred

Verifiable - easily and accurately measurable at any time

Permanent – defined as minimum 100 years duration. [In 2018, IPCC published an equation to calculate gradual decay of biochar in soils and specifically identified biochar as a sequester.]



No Leakage - action does not cause GHG emissions to simply occur elsewhere.

To participate in Carbon Markets, biochar must meet international published standards, and submit an independent Life Cycle Analysis (LCA) certifying sustainable practices were used in calculating emissions produced during production. Heat produced by pyrolysis must be used for a useful purpose.



Removing carbon in the US corn belt 124 € / CORC

Carbon Removal Information 

-  Biochar
-  Photosynthesis
-  Pyrolysis
-  Biochar

Status of production  : Audit scheduled

Year of first issuance : 2021

-  Favourite
-  Compare
-  Share
-  More



THANK YOU

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I'M HAPPY TO RESPOND TO YOUR QUESTIONS OR DISCUSS SPECIFIC SITUATIONS

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